Citrus Industry

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This is the season of State, District and County Fairs in Florida, and reports from those already held indicate that never before has there been such a varied display of the products of the state.

Outstanding among these Fairs are the Florida State Fair now in progress in Tampa and the Florida Citrus Exposition soon to open in Winter Haven. At each of these Fairs, Florida citizens and winter visitors will have the opportunty of seeing the products of the state artistically displayed. While the Florida State Fair embraces all the products of the state, citrus and citrus by-products are the central attraction, particularly for our winter visitors. The Florida Citrus Exposition is primarily a citrus expostion, as its name implies, and probably brings together in one body a greater display of citrus fruits and citrus by-products than can be found anywhere else in the world. Both of these Fairs are highly educational, not only to our out-of-state visitors but to many Floridians as well.

It is well worth the time and effort to visit as many of these Florida Winter Fairs as possible. Both Floridians and visitors will know the state better after such visits.

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Vol. 31, No. 2 February, 1950

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Spray Program On Citrus For February 1950...

JAMES T. GRIFFITHS, JR., AND W. L. THOMPSON
FLORIDA CITRUS EXPERIMENT STATION, LAKE ALFRED

As this article is being written it appears that the spring of 1950 may very well be an early one. No one can predict what temperatures will occur in February, but as early as the middle of January growth had started on many trees all over the citrus area. Rain in December coupled with warm weather in late December and January have produced conditions satisfactory for growth. In many groves growth is two or three inches in length and bloom buds are very obvious. This early growth may complicate the entire spray program for citrus, and in any case, groves are certainly susceptible to freezing temperatures. In many cases the dormant sprays have been delayed and it will be impossible to apply them before growth has actually started. In a few instances it is entirely possible that copper sprays will be applied for melanose control during the later part of February.

Purple Mites

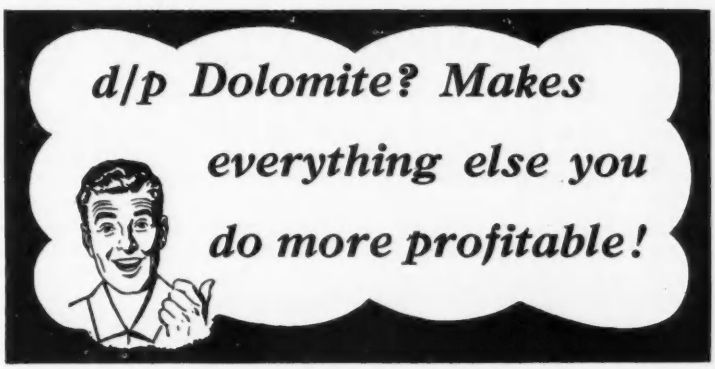
Numerous reports on purple mite injury continue to come into the Experiment Station. DN has been in short supply and many growers have been faced with the problem of purple mites and no spray material. With growth beginning to appear, it becomes necessary to decide what to use for purple mite control and when to apply it. As long as growth has not started it is suggested that DN sprays be used. These will give more satisfactory control than dust applications. Where pin-point growth has occurred sprays may still be used. It is possible that a very small amount of injury may occur, but this will not be severe. However, where growth has proceded to such an extent that leaves are starting to unfold and flower buds are starting to form, sprays should not be used. Under these circumstances dust may be applied safely, and it is suggested that control be accomplished in this manner. It is necessary to mention again that dusts are not usually as satisfactory as sprays for purple mite control, and where they are to be used good coverage is essential. This means adequate poundage per tree and the dusters must be used so that coverage is complete over the entire surface of the tree and especially in the tops. If this is done, control will generally be satisfactory.

Another alternative is an oil emulsion spray. One percent actual oil will control purple mites and should not injure the foliage and flower buds to any extent. However, an oil spray is somewhat hazardous at this time because of possible cold weather during February. Oil should not be used if the soil is dry and the trees are suffering for moisture.

Six-Spotted Mites

Six-spotted mites have not been a general problem for several years, but several reports of relatively heavy six-spotted mite infestations have been reported during January. It is suggested that growers be on the lookout for this mite and that they be prepared to control it. Six-spotted mites are generally found on the under side of the leaf and particularly along the midrib. Where they are present in heavy concentrations, they cause the upper surface of the leaf to take on a yellow splotched appearance. Six-spotted mites may be controlled with either lime-sulfur or DN. Where lime-sulfur is to be used apply 1 to 2 gallons of lime-sulfur plus 10 pounds of wettable sulfur per 100 gallons of spray. If DN is to be

(Cntinued on page 12)



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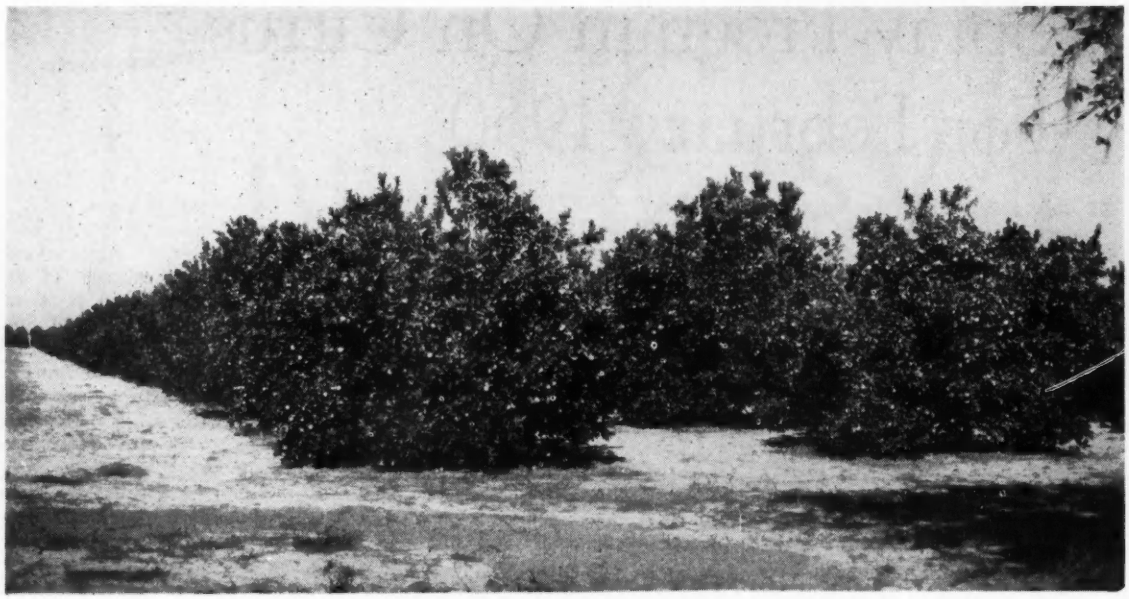

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Observations On Boron Deficiency In Citrus . . .

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AT MEETING OF
FLORIDA STATE HORTICULTURAL SOCIETY

Although the presence of boron in plants was discovered nearly a century ago, it was not shown to be an essential element for the normal growth of plants until 1914 (9). The first demonstration of the essential nature of this element for the growth of citrus was made by Hass (7) in 1929, by the use of sand cultures. Grapefruit, lemon, and orange all failed to develop properly in those cultures from which boron was withheld. Several deficiency symptoms were described in detail by Hass and Klotz in 1931 (8). Roy (12) induced boron deficiency in grapefruit in sand culture in Florida in 1943 and found that arsenic induced deficiency symptoms even though boron was present in amounts that would seem adequate. During the past three years we have grown young Valencia trees under conditions of very limited boron supply and several symptoms have resulted which appear to have some diagnostic value in the field. Gumming of the fruit, lumpiness, and a hard, dry fruit are almost universally recognized as characters which result from the lack of an adequate supply of boron. Leaf symptoms, on the other hand, are not generally recognized. The present report lists the chief fruit and vegetative symptoms of boron deficiency from previous work and those found in our outdoor sand-culture experiments at Orlando (table 1). On the basis of these symptoms, or a large number of them, several groves in central Florida were suspected of showing varying degrees of stress due to lack of this element during the very dry winter and spring of 1948-49. One grove was selected for detailed study, and all of the available evidence seems to indicate that boron deficiency was present under field conditions. Since the only reported case of definite boron deficiency in a citrus orchard appears to be that described by Morris (10) in South Africa, the present findings are given in some detail.

Boron deficiency symptoms in the fruit have frequently appeared in Florida in conjunction with application of lead arsenate, and boron sprays are helpful in remedying the situation. Similar symptoms have been noted (4,5) periodically in the absence of arsenic antagonism; but a response to soil applications of boron was not evident, while toxicity symptoms sometimes resulted and the deficiency symptoms usually disappeared regardless of whether boron was applied or not. A dry soil condition has been found to induce deficiency symptoms in apples (1) and other plants even though the soil is not necessarily deficient in boron. Citrus rootstocks have been shown (6,12,13) to influence the boron supply to the scion. Sour orange roots are relatively poor feeders for this element, while grapefruit, trifoliata, and Cleopatra mandarin are among the best of the tested rootstocks for supplying it. Sweet orange and Rough lemon are intermediate in this respect.

The grove selected for study consists of about 10 acres on Lakeland (formerly classified as Norfolk) sandy soil near Eustis, Florida. The pH of the topsoil is about 5.5. It is planted almost equally to three orange varieties (Washinton Navel, Hamlin, and Temple), all on sour orange stock. The trees are about 9 years old and have received uniform cultural treatment, which included no boron fertilization insofar as it is possible to ascertain. When first seen early in March 1949 the trees were still dormant and the Washington Navels showed rather severe distress symptoms in the foliage (only a few scattered fruits were present) that appeared identical to those in the young Valencia trees on a low-boron ration in sand cultures. About 50 to 60 percent of the leaves were affected. The principal symptoms present were: (a) Yellowing along midrib and lateral veins, (b) veins somewhat

swollen on upper surface of the leaf with occasional splitting and corking, (c) some leaves (non-chlorotic ones) thickened and somewhat brittle, (d) buckling of the leaves which throws the internal area of the leaf blade upward or downward in relation to the margin,

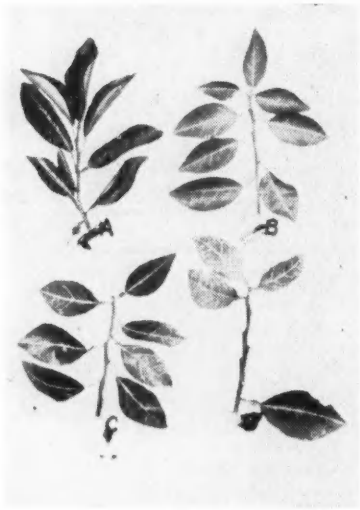

Fig. 1.

Four-month-old Valencia terminals from two-year-old trees in sand culture. A, terminal from healthy tree; B-D, terminals from trees fed with boron-deficient culture solution showing progressively advanced symptoms which culminate in defoliation. The midrib yellows first, and this is followed by general veinal chlorosis.

(e) some terminals rosetted as a result of shortened internodal areas of the stem, (f) dead areas of bark on some of the younger twigs and (g) a dull, lusterless appearance of the foliage in general. The youngest leaves on the trees were the most severely affected ones (about 8-month-old leaves from the 1948 summer growth cycle). Those leaves with the yellowish veins abscised soon after this condition developed, leaving areas of bare branches on the tree. The thickened leaves (non-chlorotic) are rather persistent and do not appear to show a shortened life. The symptoms were somewhat worse on the south and southwest exposures, although they could be found on all portions of the tree.

The crop of fruit had been picked, but an occasional off-bloom fruit was present. A few of these showed a lumpy contour and gum deposits in the albedo layer of the peel.

Symptoms as described, although somewhat more intense, were also found in a few sour orange trees that developed after the Navel scions had died out several years previously. There was considerable fruit on these trees, most of which was undersized, hard, dry, and mummified in appearance. Gumming was very common in the albedo, in the inner tips of the locules near the central axis of the fruit, as well as in the axis. Veinal chlorosis was very prominent. Since these sour orange sprouts appear to be even more sensitive in limited boron supply than budded varieties, they may prove to be useful indicators of boron deficiency when they happen to occur in an orchard.

The Hamlins showed slight, but similar, foliage symptoms but no fruit could be found to examine. The Temple trees showed no leaf symptoms at all and were carrying a good crop of normal fruit.

The three varieties are in separate areas of the planting; but the soil is quite uniform over the entire area, which suggests that the scion variety may be an important factor in the expression of deficiency symptoms.

On March 16, a borax spray (1 lb,:100 gal.) was applied to the Navels, one row being left unsprayed for further observation. This was applied with a liquid sulfur spray. One row was sprayed with the sulfur and then borax was added for the remainder of the grove. The one row which did not receive boron is hereafter referred to as "unsprayed." The spring growth had not yet appeared, being delayed by the drought. On March 29, new growth was present in profusion on the sprayed trees but virtually absent on the unsprayed trees. A similar delay in new growth has been reported in the case of apples that were under stress for boron (3). Only 3 terminals of new growth could be found on the 17 unsprayed Navel trees. These young leaves were unduly yellowish in color and were removed for analysis, along with a set of comparable size from an adjacent sprayed row. Although the leaves were of nearly the same size, the leaves from the sprayed trees were much greener and somewhat thicker, as is indicated by their greater dry weight (table 2). Young Valencia leaves from trees receiving low and adequate amounts of boron (about 0.001 and 0.5 p.p.m. B in the culture solution, repsectively) in sand cultures were taken for comparison (table 2).

The unsprayed Navel trees put out a bloom and flush of leaves about 8-10 days after the sprayed

Table 1. Gross symptoms of boron deficiency in citrus as noted by various workers

Symptoms	Haas	Roy	Morris	Smith & Reuther
1. Curling, or buckling, of leaves, either upward of downward (fig. 1)	Yes	Yes	—	Yes
2. Yellowing along midrib and lateral veins; normal thickness; tendency to abscise prematurely (fig. 1)	Yes	—	—	Yes
3. Enlargement of midrib and lateral veins (fig. 1)	Yes	Yes	—	Yes
4. Splitting and corking of veins on upper (ventral) side of leaf	Yes	Yes	No	Yes [1]
5. Some leaves thickened; somewhat leathery, but brittle and persistent	Yes	—	—	Yes
6. Some deformities of thickened leaves, such as blunt, notched, and heart-shaped apices	—	—	—	Yes
7. Rosetting or whorled clusters of leaves due to shortened internodes of stem	—	—	—	Yes
8. Browniish green leaf color, lack of luster	Yes	—	—	Yes
9. Multiple buds	Yes	—	—	Yes
10. Premature defoliation of some stems	Yes	Yes	Yes	Yes
11. Dieback of young, defoliated stems	Yes	Yes	Yes	Yes
12. Gum pockets in internodes of stem	Yes	—	—	Yes
13. Normal to heavy blossoming	No	Yes	—	Yes
14. Excessive fall of young fruit	Yes	Yes	—	Yes
15. Gumming of albedo layer of rind	Yes	Yes	Yes	Yes
16. Gumming of inner tips of fruit locules	No	—	Yes	Yes
17. Gumming of core, or axis, of fruit	Yes	No	Yes	Yes
18. Misshapen, hard, or dry fruit	Yes	Yes	Yes	Yes
19. Shriveled, darkened, or undeveloped seed	No	—	Yes	Yes
20. General tree resemblance to exanthema, or copper deficiency [2]	Yes	Yes	Yes	Yes

[1] Infrequently found.

[2] Twisting and downward drooping of vigorous shoots, and symptoms 9, 10, and 11.

trees. No discernible difference in the number of flowers were evident in relation to the spray treatment. The bloom was very heavy throughout and flowers were frequently found on completely defoliated branches (fig, 2,B), indicating that the ability to flower was not impaired by the affliction. This same observation had previously been made with the Valencias under controlled conditions. Many of the defoliated branches that flowered did not produce new leaves and failed to set fruit. A gradual dying back of these young limbs followed.

Several additional samplings of this spring-growth flush were made during the spring and summer (table 2). In each case the trees that were sprayed produced slightly larger leaves and these had more boron in them than the untreated trees. The differences are not large but tend to substantiate the visible evidence that the sprayed trees are making the most rapid recovery. The fact that considerable defoliation had taken place at the time of treatment should be taken into consideration. It seems highly probable that the effect of the spray would have been much greater if it had been applied earlier when all of the older leaves were still on the trees. About 40 to 50 percent of the leaves had fallen when the spray was applied.

All the trees showed increased boron in the leaves with the advent of the summer rains that started in June. The content, however, was still relatively low, indicating that the trees were getting boron from the soil only in limited amounts even in the rainy season. Healthy, mature orange leaves usually show from 40 to about 200 p.p.m. of boron (11). By comparison, the mature Valencia leaves on low boron ration showed an average of 14 p.p.m. total boron and showed strong deficiency symptoms.

As the spring-flush leaves developed on the unsprayed trees, mild boron deficiency symptoms appeared (b, c, d, and e as listed in text). They were entirely absent on the comparable leaves of the sprayed Navel trees.

The main summer-flush of growth occurred in mid-August. No deficiency symptoms were found in the very young leaves, and they had (table 2) what would appear to be a normal amount of boron for week-old leaves. There was still some effect of the March spray treatment as the leaves from these trees showed over 25% more boron (compare 29 and 37 p.p.m. boron). These leaves appeared during a period of adequate moisture supply and differ sharply from leaves of a similar age from the same trees taken in March under drought conditions. The respective boron concentrations at that time were 4 and 21 p.p.m. This substantiates the evidence with other types of plants that soil moisture influences boron availability.

The native boron supplying power of the soil in this particular grove is relatively low as shown by the following test. On August 24 three ounces of borax (18% B2O3) per tree was applied to the soil around each of five trees of the 17 unsprayed trees and to a like number of trees that had received the original boron spray. A hurricane, which occurred during the next few days, brought about four inches of rainfall. Five weeks later (September 29) the tree response was such that the treated trees were pointed out by an observer who did not know which trees had been given the soil application. A deeper green color and longer shoot growth served to distinguish the trees that had received the three ounces of borax from those that did not. Many of the six-week-old leaves on the trees that did not receive the three ounces of borax showed a whitish-yellow color of the midrib and a general off-green color. These symptoms of mild boron deficiency were present on both unsprayed and sprayed trees. The leaves of these two treatments were also nearly identical in their boron content (compare 24 and 26 p.p.m. for 9-29-49 in table 2). The leaves of a similar age from the trees which received the soil applications showed about 48 p.p.m. boron, and here again no difference was induced by the spray application of the previous March. The values of 24 and 26 p.p.m. are somewhat low for a nearly mature leaf. The better appearance of the trees as a result of the ground application suggests that even with abundant soil moisture the trees were limited in growth by the lack of adequate boron from the untreated soil.

Despite the poor condition of the foliage at the time of bloom and the relatively light set of fruit, it appeared that somewhat more fruit was set on the sprayed trees. To measure this response, counts were

(Continued on page 20)

Table 2. Leaf weight and boron content of Valencia and Navel orange leaves of different ages and with different boron treatments.

Variety	leaf age, and treatment	Date sampled	Mean leaf wt. mgm.	p.p.m. Boron in dry leaves	Micrograms Boron per leaf
Valencia,	1 week(s), low boron [1]	3-29-49	34	6	0.2
"	1 " ± " [2]	"	35	28	1.0
"	18 " low " [1]	7-10-48	274	14	3.8
"	18 " ± " [2]	"	283	140	39.3
Navel,	1 " Unsprayed	3-29-49	50	4 [4]	0.2
"	1 " Sprayed [3]	"	80	21 [4]	1.7
"	5 " Unsprayed	4-29-49	196	12	2.4
"	5 " Sprayed	"	214	17	3.6
"	10 " Unsprayed	6-14-49	274	15	4.1
"	10 " Sprayed	"	297	26	7.7
"	18 " Unsprayed	7-29-49	294	22	6.5
"	18 " Sprayed	"	300	33	9.9
"	1 " Unsprayed	8-24-49	89	29	2.6
"	1 " Sprayed	"	81	37	3.0
"	6 " Unsprayed	9-29-49	325	24	7.8
"	6 " Sprayed	"	311	26	8.1
"	6 " Unsprayed [5]	"	318	48	15.7
"	6 " Sprayed [5]	"	300	47	14.1
Valencia,	18 " Mean, 29 mature Florida groves		95		—

[1] 2-year-old Valencia/RL in sand culture with about 0.001 p.p.m. B. Deficiency symptoms were present but affected leaves were not included in the samples.

[2] 2-year-old Valencia/RL in sand culture with about 0.50 p.p.m. B.

[3] Trees sprayed with 1 lb. borax per 100 gal. on March 16, 1949, before the appearance of these leaves.

[4] Single sample. All Valencia values are the mean of four samples; all other navels the mean of three.

[5] 3 ounces of borax applied to soil around each tree on 8-24-49.

Progress Report On Citrus Decline . . .

R. F. SUIT AND L. C. KNORR
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AT MEETING FLA. STATE HORT. SOCIETY

Introduction

Previous to 1945, any tree showing a poor growth or dying was classified as having decline. Thus citrus decline assumed the role of a specific disease although no actual cause was indicated. In 1947, a preliminary report (1) indicated at least 10 common conditions or diseases which were causing decline in different groves. Since that time "decline" has been used in a general sense to refer to the condition of the tree without indicating any particular disease.

Additional data on the overall decline problem have been obtained during the past two years, and form the basis of this report. Two of the diseases in the decline complex are treated in particular—root rot and spreading decline. With regard to the former, no specific experimental work has been carried on, but sufficient information has been obtained to indicate various factors that influence the occurrence of this disease. Spreading decline has received major emphasis, and the results of the different phases of the work to date are given here.

Prevalence Of Decline

The survey to detemine the relative prevalence of the various types of decline throughout the state has been continued. As of November 1, 1949, a total of 387 groves have been examined to determine the cause of the decline. As shown in Table 1 spreading decline, root rot, foot rot and water damage were the four most important causes. One of these four types was present in 81 percent of the groves examined. Of the four, foot rot is well known and can be controlled by recognized methods. Water damage is a result of weather and soil conditions, and as such is beyond easy means of control. Root rot and spreading disease decline are comparatively new and most of this report concerns these two diseases.

Root Rot

The root rot condition that develops in citrus trees appears to be initiated in the fibrous roots and gradually progresses to larger roots towards the trunk of the tree. When sufficient roots have become diseased the top of the tree will begin to show decline. This may require two or three years or less than one year depending on the severity of the root rot. Eventually the branches will die back and the center of the tree will develop numerous water sprouts showing various types of deficiency symptoms in the foliage. When root-rot-infected trees are pulled the crown and top roots are usually normal and no large number of diseased roots can be observed—a consequence of the diseased roots breaking off and remaining in the soil. The specific fungus or fungi involved in the production of the root rot have not been determined but **Physalospora rhodina** (Berk. and Curt.) Cooke (**Diplodia natalensis** Evans) is usually found in the diseased roots. This fungus is not considered to be a vigorous pathogen and observations of root rot occurrence in the various groves indicate that the infected trees have usually been weakened by adverse conditions before the root rot developed.

Table 1.
Causes of Decline and Their Occurence in Citrus Groves Examined

Cause of Decline	No. of Groves
Spreading Decline	93
Root Rot	87
Foot Rot	82
Water Damage	51
Psorosis	23
Lightning Injury	13
Nutritional Deficiency	12
Heart Rot	11
Algal Disease	9
Drought Injury	6
Total	387

There are a number of factors that have been observed to influence the prevalence of root rot. When growing under such conditions, the trees become predisposed to infection and root rot can readily develop.

1. **Water Relations.**—Trees growing under conditions of extreme variation in the water level in the soil, and those where a constant water level is present within two or three feet of the surface will have a certain proportion of the roots injured at different times during the year. Such roots can readily be infected by the fungi that cause root rot.

2, **Age of Tree.**— A young tree may make satisfactory growth in the same location where later it falls prey to root rot. The root system gradually extends through the soil as it becomes older, and when the roots have reached a point where they encounter unfavorable conditions, injury occurs and root rot can develop. In a number of cases groves have become 20 years old and then trees started to die out from root rot.

3. **Rootstock.**— Sour orange rootstock is more resistant to root rot than rough lemon, grapefruit, or sweet orange; it will, however, develop root rot under extremely adverse conditions.

4, **pH of Soil.**— Root rot is apt to be of more importance when the soil shows a pH of 7 or above. A good exmaple of this is the so-called "road- side decline" where leaching from the crushed lime rock base of the highway has affected the soil in the row of trees adjacent to the road.

5. **Type of Soil.**—In general, root rot tends to be more of a problem on heavier soils. Also, in these soils where an impervious layer of rock, clay, or hard pan occurs within two or three feet of the surface, the incidence of root rot will be higher.

6. **Lightning Injury.**—In several instances trees that were known to have been slightly injured by lightning have developed root rot in subsequent years.

7. **Hurricane Damage.**— During severe windstorms the trees are

severely shaken and twisted even though they are not blown over. This injures a portion of the roots in the soil and establishes conditions which are favorable for the occurrence of root rot.

Trees that become diseased with root rot do not usually recover and should be removed as soon as they are uneconomical. Treating the soil around root rot trees with 20 pounds of copper sulfate per tree or buck-horning the trees have not been beneficial. Young trees replanted in place of the diseased ones have always made excellent growth. In some cases replanting has been done immediately and in other instances a few months after removal of the old trees.

Spreading Decline

A discussion of the symptoms of spreading decline, its rate of speed, and varities of citrus and rootstocks affected have previously been reported (2). Since that report was presented, an additional 39 groves have been observed in which spreading decline occurs. Present distribution of the 93 affected groves in the various counties is as follows: Polk—66, Orange—8, Highlands—5, Manatee—5, Hillsborough—3, Pinellas—2, Desoto—1, Pasco—1, Seminole—1, and Brevard—1.

The outstanding characteristic of this type of decline is the gradual spread of the disorder through the grove. There was a wide variation in the rate of spread observed in the groves for the 1948-49 season. A total of 56 groves were mapped and the rate of spread varied from 0.7 to 11.3 trees per tree on the margin of the declining area. This rate of spread was greater than has been found in previous years (2). It has been suspected that the rate of spread might be accelerated by drought conditions. As shown in Table 2, there is an inverse correlation between the amount of rainfall occurring between October 1st and June 1st and the rate of spread, i.e., the less rainfall, the greater the rate of spread. To obtain these data 11 groves were mapped five times, 8 groves four times, and 7 groves three times at yearly intervals.

There are several possible causes that could induce spreading decline. Some of these are: a toxic organic material in the soil, a virus in the tree, fungus infection of the fibrous roots, the feeding of small insects on the roots, or nematodes infesting the fibrous roots. The senior author has reported (2) that preliminary investigations did not indicate the presence of a virus or a fungus disease. However, it was reported that the citrus nematode (**Tylenchulus semipenetrans** Cobb) was present in some groves and might be a causitive agent for this type of decline.

Table 2.
Relation Between Rainfall and Rate of Spread of Spreading Decline.

	1945-46	1946-47	1947-48	1948-49
		Inches of Rainfall		
Oct. 1st to June 1st	24.22	24.59	27.01	13.83
		Average Rate of Spread		
11 groves	0.79*	1.2	1.02	2.21
19 groves	——	1.26	1.03	2.82
26 groves	——	——	1.10	3.16

* Increase in number of diseased trees per tree on the margin of the declining area.

Assuming, as a working hypothesis, that the citrus nematode was the cause of spreading decline, a study of the nematode population in the various groves has been conducted during the past two years. High citrus nematode populations were found in 25 percent of the 93 spreading decline groves and in 6.5 percent of the 108 apparently healthy groves examined. The 23 groves in which the citrus nematode was definitely a problem showed a different type of decline when observed over a period of years than did those groves where this nematode was absent and which were typically spreading decline. Consequently, this would indicate that some of those groves which were previously classified as spreading decline, are of a type not yet included in the decline survey and known in California as "slow decline". An area of decline induced by the citrus nematode may be confined to a portion of a grove or involve the whole grove. The distinguishing characteristic is the variation in the amount of decline shown by the individual trees in the general decline area in contrast to spreading decline where all the trees in the declining area show the same degree of decline. There is usually no sharp border between the slow decline area and the rest of the grove as is the case with spreading decline. Those healthy groves in which the citrus nematode was present may develop slow decline in years to come. In one Valencia block, slow decline showed up within three years after observations started. However, the length of time that the citrus nematode was present previous to the first observation of the grove is not known.

Since it appears that the citrus nematode is not a problem in the 70 groves which have typical spreading decline, it is possible that some other nematode might be causing the trouble. Counts of the total nematode population on the fibrous roots from 31 spreading decline groves and 29 healthy groves were made by the Baermann funnel technique. These counts showed such a similarity with respect to population and types that it is questionable whether another nematode is involved in spreading decline.

It is therefore imperative that some of the other possible causes of spreading decline be thoroughly investigated. Dr. I. W. Wander, Soil Chemist at the Citrus Experiment Station, is conducting a series of experiments to determine whether some toxic material in the soil might be involved. In some instances very small insects have been found associated with fibrous roots of citrus trees. However, these have not been found consistently on roots from the various areas of spreading decline and it appears that they are not causing any serious damage.

There are several important virus diseases of citrus, some of which are tristeza, quick decline and psorosis. Although the preliminary experiments (2) did not indicate the presence of a virus disease, a through investigation of this possible cause is in progress. A planting of various citrus seedlings and young budded trees has been established and tests are being conducted in this block, as well as the quarantine cage and the greenhouse to determine whether any virus diseace is implicated.

Previously (2) it was found that a species of **Fusarium** could be consistently isolated from the roots of spreading decline trees. However, at that time, it was not possible to

(Continued on next page)

Pasco Lines Up With Florida Citrus Mutual . . .

The signing of Pasco Packing Company, world's largest citrus plant, with the Florida Citrus Mutual gives this super-cooperative control of 92 percent of the state's citrus tonnage, by far the greatest percentage of any cooperative in the land. It brings to Mutual a great opportuity and a vast responsibility. Discussing this achievement by Mutual, a well known Florida citrus factor said to the editor of this publication:

"Florida Citrus Mutual now has the opportunity to prove the desirability of cooperative effort among citrus growers; it is also burdened with a great responsibility. If it succeeds, the merit of cooperative effort cannot be questioned; if it fails, no further effort at cooperation among citrus growers may be expected to succeed.

"Mutual was conceived by growers developed by growers and organized by growers. If the growers maintain their loyalty to the aims upon which Mutual was founded; if shippers, packers, canners and concentrators live up to their contracts with Mutual; if Mutual's officers and directors live up to the principles on which Mutual was built, there can be no doubt of its success. But, there must be strict adherence to those fundamental principles all along the line.

"That Mutual has already done much for the industry is amply proven; that much more will be done, I confidently believe. I am convinced that lasting cooperation among citrus growers has at last been attained."

That is a sentiment in which everyone connected with the industry will heartily agree.

PROGRESS REPORT OS CITRUS DECLINE

(Continued from preceding page)

prove its pathogenicity. It still remains a possibility that spreading decline is the result of a fungus disease of the fibrous roots. A reinvestigation of the fungus angle is in progress. Large numbers of isolations are being made and inoculation experiments will be established covering a wide range of soil moisture and temperature conditions. Other factors that might influence root infection will also be studied.

Numerous experiments were conducted during the past five years in an attempt to control spreading decline. In the years 1945, 1946, and 1947 a total of 746 trees were treated by various methods. These were: trenching, chemotherapy, pruning or buck-horning and soil treatment with three kinds of mulches and 8 different chemicals at varying amounts. None of the treatments used during these three years has, to date, been successful or even given an indication that a partial control might be obtained. During 1948 and 1949 soil treatments with soil fumigants and organic insecticides were conducted. There were 452 trees around which the soil was treated with some of these materials. A total of 8 acres of grove was removed, the soil treated with D-D at 400 pounds per acre, and the areas replanted a month or more later. In another instance, at least 10 acres of grove were removed, the soil treated with benzene hexachloride (10 percent gamma isomer) at 100 pounds per acre, and then replanted. It is too soon to observe results where the replanting of an acreage was made after treatment. In the experiments involving 452 trees, none has shown satisfactory recovery of the trees or preventing them from declining. In one instance, a soil treatment with a mixture of parathion and benzene hexachloride in water gave a significant reduction of 50 percent in the total nematode population of the roots. However, the trees have not yet shown any beneficial effect. In another case it appeared that trees treated with 5 or 3 pounds per tree of benzene hexachloride (6 percent gamma isomer) on the soil and disced in, did not show as much decline as adjacent non-treated trees. However, there has been no satisfactory recovery from any of the treatments to date.

A survey of 387 groves during the past five years showed that the four major causes of decline were spreading decline, root rot, foot rot and water damage and that these caused decline in 81 percent of the groves examined.

There are seven factors that influence the occurrence of root rot: water relations, age of tree, rootstock, pH of soil, type of soil, storm damage to roots, and lightning injury to roots.

A total of 93 groves have been observed in which spreading decline is present. The yearly rate of spread is accelerated by a reduction in rainfall between October 1st and June 1st. Among those groves previously classified as spreading decline, a total of 23 groves can now be classed as slow decline and are definitely associated with the citrus nematode **Tylenchulus semipenetrans** Cobb. The exact cause of the condition in typical spreading decline groves is not known.

Experiments on the control of spreading decline involving 1198 trees and an additional 18 acres of grove where the trees were removed have not shown any beneficial results to date. However, in some instances it is too early for a final answer.

Literature Cited

1. Suit, R. F. and E. P. DuCharme. Citrus decline. Citrus Industry 28 (7): 5-8, 13. 1947.

2. Suit, R. F. Spreading decline of citrus in Florida. Proc. Fla. State Hort. Soc. 60:17-23. 1947.

USDA CHEMISTS WIDEN INDUSTRIAL AND FOOD USES FOR FARM PRODUCTS

New foods, new cotton fabrics, better means of storing and processing essential oilseed crops, and advances in the use of farm products as industrial raw materials are among the research achievements described by the U. S. Department of Agriculture's Bureau of Agricultural and Industrial Chemistry in its annual report for fiscal year 1949, released recently.

Chief of Bureau Dr. G. E. Hilbert, in submitting this report to the Department's Agricultural Research Administrator, emphasized that many of the new developments resulted from cooperative studies by his agency and other research organizations throughout the country. The Bureau works closely, he said, with State agricultural experiment stations, colleges and universities, farmer cooperatives, and industrial firms, as well as with other agencies of the Federal Government .

Frozen orange and lemon purees, now made commercially in California by methods worked out in Bureau laboratories, are cited in the report as food products of increasing interest to bakers, dairies, and beverage manufacturers.

Swift's Growers Advisory Service Has Helped This Citrus Nursery For Over 15 Years . . . .

LAKE GARFIELD NURSERIES COMPANY
Citrus Trees Exclusively
BARTOW, FLORIDA

"The Progressive Nursery of Florida"

Swift & Company,
Plant Food Division,
Winter Haven, Florida.

Gentlemen:

Enclosed is a recent photograph of one of our groves which contains 44 acres of Pineapple Orange trees, and is now 11 years old.

This grove in its fifth year showed a net profit of $1742.30 and has continued to show a good profit each year with continued increase in production.

The total number of boxes produced by this grove to date, including the fifth year through the eleventh year, is 63,835, and brought net on the trees $72,590.77, and the total production costs through the same years, including depreciation has been $27,964.44, leaving a net profit of $44,626.33.

As you know we have had some good and bad years during the period of time mentioned above.

We believe the outlook for the citrus growers was never brighter than it is now, provided the grove is planted with high quality trees on suitable land, and properly cared for.

Primarily our business has been citrus nurseries in which we have taken great pride in growing quality trees for our customers. WE HAVE BEEN USING SWIFT'S FERTILIZER AND GROWERS SERVICE FOR 15 YEARS WITH VERY SATISFACTORY RESULTS, BOTH IN NURSERIES AND GROVES.

Yours very truly,
LAKE GARFIELD NURSERIES CO.,
R. L. Bryan, Sec.-Treas.

Helping Growers Produce BIGGER YIELDS of TOP QUALITY is the Sole Purpose of Swift's Growers Advisory Service. Write for Complete Information.

SWIFT & COMPANY

PLANT FOOD DIVISION WINTER HAVEN, FLORIDA

MAKERS OF RED STEER AND VIGORO PLANT FOODS

State of Florida Receives Merit Award at Frozen Foods Convention . . .

The State of Florida received a distinguished merit award for making the greatest contributions in the public welfare to the progress of the frozen food industry, at the fourth annual National Frozen Foods Convention opening in Chicago on Jan. 31.

Announcement of the award was made by William M. Walsh, of Pittsburg, chairman of the convention, and president of the National Wholesale Frozen Food Distributors Association, the group presenting the award to Florida's Gov. Fuller Warren in behalf of the state. This marks the first time in the history of the award that it has ever been given to a State; in previous years individuals or corporations were so honored, Walsh explained.

Industry spokesmen reported that fruits and juices accounted for 38 per cent of the record volume of frozen fruits eaten during the year; with vegetables accounting for 32 per cent; and poultry ranking third with a 13 per cent rating. Sea foods ranked fourth with 11 per cent; and frozen meats; and precooked and other specialty items tied for fifth position with three per cent.

Other figures showed that every person in the U. S. consumed frozen foods at the rate of six pounds a year; three pounds of fruits and three pounds of vegetables. It was also indicated, on the basis of a survey, that the average American family eats twice as many frozen peas, as fresh.

A hit parade of the nation's six most popular foods which were served most often by housewives were:

No. 1—Frozen orange juice.
No. 2—Frozen peas.
No. 3—Frozen strawberries.
No. 4—Frozen lima beans.
No. 5—Frozen green beans.
No. 6—Frozen spinach.

Frozen orange concentrate is the skyrocketing product in the field, the industry pointed out. In 1949 orange juice accounted for 12½ per cent of the nation's entire frozen food output, and in 1950 it is expected that it will amount to one-quarter of the total, and that 35 per cent of the orange crop in Florida would end up in the six ounce cans.

CONSUMERS QUERIED AS TO THEIR TASTE FOR CANNED CITRUS JUICES

Taste reactions of consumers to different blends, or varying proportions, of canned orange and grapefruit juices are shown in a report by the U. S. Department of Agriculture.

The report, "Consumers' Taste Reactions to Three Blends of Orange and Grapefruit Juice," is the result of a study conducted by the Bureau of Agricultural Economics. Cooperating were the Florida Canners' Association, the Florida Agricultural Experimental Station, and the Florida Citrus Commission. The research was financed by Research and Marketing Act funds.

It was found that most consumers were not able to detect taste differences caused by varying the proportions of orange and grapefruit juices as long as the changes were kept within certain limits. Blends of orange-grapefruit containing 40, 50, and 60 percent of orange juice are almost equally acceptable to consumers. And there are no important differences in the attitudes of consumers from Northeastern, southern, and western areas of the country, according to the study.

More than half the consumers surveyed used either canned orange juice, canned grapefruit juice, or canned blends. Most of those who used canned citrus juices served them at least once a week.

More of the families used canned orange juice than used the other two juices. And they served orange juice more often than they served canned grapefruit or the canned blends. Canned orange juice has its appeal in its flavor and taste. Those who like canned grapefruit juice and blend say it is appetizing and healthful.

SPRAY PROGRAM ON CITRUS FOR FEBRUARY 1950

(Continued from page 3)

used the recommendation is the same as for purple mites, 2/3 pound of DN per 100 gallons of spray. Dusts should not be used for six-spotted mite control because of inadequate coverage on the under surfaces of the leaves.

Scale Control

Scale populations are generally at a low ebb in most groves. However, crawlers have been produced during January, and both purple and red scale populations have increased. Numerous questions concerning the use of parathion for scale control this spring have come into the Experiment Station. Suggestions for the use of parathion and precautions concerning its use have been printed and are being distributed with the Citrus Spray Schedule in the Better Fruit Program this spring. Copies of these may be obtained by writing either the Florida Citrus Commission at Lakeland or the Florida Citrus Experiment Station at Lake Alfred. All of the precautions which have been listed are included for a definite purpose, and it is strongly recommended that every and all precautions listed be adhered to by those growers who will use parathion.

Where two parathion sprays are being planned for the control of scale in 1950, the first spray would normally be applied at post-bloom time. However, where the grove to be sprayed will have fruit still on the trees, complications concerning picking dates may arise. Therefore, under these circumstances, it is suggested that the first parathion spray be applied during the dormant period. February should be an excellent month for the application of this spray. Under this type of program it is suggested that the first parathion spray be at the rate of 1 pound of 15 percent wettable material per 100 gallons of spray. This is to be applied with 10 pounds of wettable sulfur to the 100. Neutral zinc and/or copper may be included in this application. If zinc sulfate is to be used, 1 pound of lime is sufficient to neutralize 3 pounds of zinc.

If heavy scale infestations are present, use 1 2/3 to 2 pounds of 15 percent parathion per 100 gallons of spray.

For more specific information consult the Florida Citrus Experiment Stations at Lake Alfred or at Fort Pierce.

CONTRACT LET FOR MARKETING STUDY IN CITRUS - DRIED FRUITS

Buying practices of household consumers in the purchase of citrus fruits, dried fruits, and fruit juices —both canned juices and frozen concentrates—will be reported in a research project announced recently by the U. S. Department of Agriculture. The purpose of the project is to furnish producers, shippers, and processors of these fruits and fruit products with information on purchases at retail by a national sample of several thousand household consumers.

The project represents a new type of cooperation in the research field, between the industry groups involved and the Department of Agriculture, since the cost of the survey will be shared by the Department and the citrus and dried fruit industries. The research was initiated following recommendations of the Citrus Fruit and Decidous Fruit Advisory Committees established under the Research and Marketing Act of 1946. The funds for the Department's participation are authorized under the terms of that Act. The Bureau of Agricultural Economics and the Fruit and Vegetable Branch of the Production and Marketing Administration are jointly responsible for the Department's work under this project.

The work of obtaining data from consumers throughout the country will be done under contract by a private marketing research agency, the Industrial Surveys Company, Inc., of Chicago, through its regularly constituted national consumer panel. Under a 12-month contract between that company and the U. S. Department of Agriculture, information on consumer purchase will be furnished to the Department monthly. Data furnished under the contract not only will reveal the total volume of each fruit or product moving into the hands of household consumers on a current basis but also will provide information on prices paid by consumers, average size of individual purchases, and types of stores from which purchases are made. The information also will include analyses, both national and regional, of consumer purchases in relation to income of family, size of household and age of household members, and other important family characteristics.

For Fruit that Grades High in the Packing House.....

HIGH-GRADE FERTILIZERS are the first essential in production of high-grading fruit. DEPEND ON GULF for the right plant foods in the right amounts at the right time to keep your grove thrifty. DEPEND ON GULF FIELD SERVICE to help you work out a complete better fruit program that is SAFELY economical. Your local GULF Field Man will be glad to talk over your grove problems from A to Z — and give you recommendations in tune with the times. Ask him to call now.

GULF Friendly FERTILIZERS

RIGHT for YOUR Soils
RIGHT for YOUR Crops

The GULF FERTILIZER COMPANY
Tampa and Port Everglades, Florida

VITAMIN "C" IN FROZEN GUAVAS

The University of Miami Food Technology department has found that the guava, which is an excellent source of ascorbic acid (Vitamin C), can be frozen either as a sliced product or as a puree.

You may prepare frozen sliced guavas in your own kitchen in the following manner. Wash, peel and remove seeds from the fruit and cut the flesh into longitudinal sections. Place the slices in moisture-vapor-proof containers and cover with a light sugar syrup prior to freezing. Frozen guava slices are used in much the same manner as the freshly sliced fruit itself.

A puree can be prepared either from the peeled or unpeeled fruit. If the skin of the fruit is free from blemishes, it is recommended that skin be included as it contains the highest concentration, according to Miss Margaret Jean Mustard, Research Associate in the University of Miami Food Technology department.

The fruit is ground to a smooth consistency in a food blender and pressed through several layers of cheesecloth to separate seed fragments and stone cells from the puree itself. A small amount of sugar may be added to sweeten the product if desired. The appearance of purees prepared from fruits having delicately colored flesh can be improved by the addition of a small amount of red artificial food coloring or juice from some highly colored fruit such as the antidesma. The puree is delicious when used as a spread on hot toast and may also become popular as a baby food due to its high nutritive content.

Possibilities Of Frozen Avocadoes

In seeking additional ways of preserving the avocado by freezing, the University of Miami Food Research Center has found that the creamy consistency of the flesh of this fruit makes it very well suited for the production of frozen purees and spreads.

You can prepare a delightful puree by mixing together in a food blender two-thirds by volume of avocado pulp, one-third by volume of a good grade salad dressing and a small amount of salt. The mixture is blended to a smooth consistency and packaged in moisture-vapor-proof containers. As the surface layer of this puree tends to darken if a partially used jar is stored in refrigerator, it is advisable to package avocado puree in two or three ounce jars so that a jar can be completely used soon after it is opened. Variations of this puree can be made by blending in some mustard along with the salad dressing and salt prior to freezing or by adding chopped onion or onion juice to the puree just before serving. Avocado puree spread on crackers or made into open-faced sandwiches make delicious appetizers.

Due apparently to the consistency of the flesh of the avocado, no satisfactory means has yet been found for freezing the sliced product.

BUY MOLASSES

Ft. Lauderdale, Fla. — Broward county farmers recently bought 50,000 gallons of citrus and cane molasses for feeding livestock. County Agent B. E. Lawton assisted them in arranging the purchase.

Trenton, Fla. — A new 4-H club for boys was recently organized in the Bell community under the direction of County Agent H. E. George. The club has 35 members.

At Blooming Time...

TO SET A BIG CROP..
OF QUALITY FRUIT..

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Calcium Nitrate

To get an early Spring start toward maturity and size and to aid in producing quality fruit at low cost, apply Calcium Nitrate at blooming time. Calcium Nitrate contains 15.5% quick acting Nitrate Nitrogen and 26% water soluble Calcium Oxide at the price of Nitrogen alone.

Since Calcium Nitrate draws moisture from the air, it is **immediately available** — no waiting for rain which may not come. This unique combination of quick acting Nitrogen and water soluble Calcium Oxide works wonders.

FOR VEGETABLE CROPS - - -

Use Calcium Nitrate for quick action and quality production.

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The Business Of Maintaining A Reputation

. . . . especially when that reputation carries with it the guarantee of fine quality and exceptional service sometimes proves something of a chore . . . . but when you think of your reputation as being as much a part of your merchandise as the merchandise itself, as we do, then the incentive to exert every effort to maintain and improve that reputation proves a strong stimulant.

The constant reports we receive from our customers telling us of outstanding crops produced by the use of Florida Favorite Fertilizers . . . . particularly when these reports refer both to exceptionally large volume and to far above the average of quality, make us determined to maintain the reputation which our fine fertilizers have established.

The future of the citrus industry of Florida looks very bright today, so we suggest that in line with the prospect for continuing high prices growers keep their trees in the highest state of good health and productiveness.

You know, of course, that when you order your fertilizer from us, it is delivered to you when and where you want it in our own fleet of delivery trucks.

Florida Favorite FERTILIZER, INC.

Old Tampa Road Lakeland, Florida

Frozen Purees From Florida Citrus Fruits[1] . . .

Owen W. Bissett
U. S. Citrus Products Station[2]
Winter Haven, Florida, at Meeting Florida State Horticultural Society

The earliest development in the art of food preservation was undoubtedly inspired by the need of extending food supplies beyond normal seasonal limits. Following early successes a second objective was introduced: that of improving the quality of the product. Food processors of today are keenly interested in maintaining the highest quality possible.

It has been only in fairly recent years that the search for better processing methods to obtain high-quality products has turned to freezing and frozen storage. It is true that as early as 1905 small fruits packed in sugar syrups were frozen in the eastern United States and that in 1909 "cold pack" berries were processed in the Pacific Northwest. It later became apparent that many users would prefer a mashed or pureed material to whole fruit. Consequently, in 1931, the Bureau of Agricultural and Industrial Chemistry instituted investigations at its laboratory in Los Angeles, California which resulted in the development of a whole new series of fruit and berry purees suited to frozen storage methods.

Citrus fruit purees were not originally included in this program as it had been thought that such products would be too strong in flavor and might develop "terpeney" off flavors in storage. In 1947, however, citrus puree investigations were inaugurated at the Fruit and Vegetable Chemistry Laboratory, Los Angeles, California, under the direction of Dr. E. A. Beavens (1). Preliminary work was done near the end of the Valencia orange season and the results were so promising that the successful commercial production began the following year.

As a result of the wide interest in and the active market demand for citrus purees, namely, the orange and lemon purees now produced in California, the Citrus Products Station at Winter Haven, Florida, instituted investigations during the 1948-49 season to determine the adaptability of Florida citrus fruits to this type of product. As the work began at the height of the Valencia orange season, this variety was chosen for the initial investigations. The results indicate that an excellent frozen puree can be prepared from this fruit.

Other varieties of citrus fruits were tested including tangerine, Tardia lime, Persian lime, and Key lime. It is anticipated that additional orange varieties will be used during their respective seasons in the coming fruit year.

Method of Processing

The method of processing the fruit was essentially that developed at the Los Angeles laboratory (1). It consisted of thoroughly washing sound, mature fruit, preferably with a good detergent and rinsing with cool or cold water, following by halfing or quartering the fruit, depending on size, and passing through a laboratory model Chisholm Ryder Sep-ro-siv[3] fitted with a screen of 0.27-inch openings. This machine operates on the principle of a tapered screw within a conical screen with the juice, peel oil, and some pulp being forced through the screen while the seeds, rag, and remainder of the rind are ejected at the small end of the screw flight. Openings larger than 0.27-inch allow the passage of particles of pulp of such size as to be objectionable in the end product. The puree obtained from the Sepro-siv was fortified with sucrose (1 part sucrose to 5 parts puree by weight) and after thorough mixing was canned and quickly frozen.

Purees stored at 0° F. for eight months show no apparent change in color, flavor or vitamin C content. Dr. Beavens (1), who has studied such products over longer periods, finds that they may be kept in good condition for more than a year. The puree may be defrosted, a portion used, and the remainder refrozen without injury to color or flavor, provided it is not exposed to the air for long periods nor the temperature of the product allowed to rise too high.

The importance of using good clean fruit is self-evident, as there is no pasteurization or other biological control during processing. By the same token it is essential that once started, the preparation be carried to completion as rapidly as possible.

Discussion

Orange Purees

The yield of puree from Florida Valencia has been found to be in the range of 55 to 60 percent by weight of the whole fruit, and contained about 18 percent suspended solids, 1 percent citric acid and 1 percent peel oil. This percentage of oil is comparable with that contained in commercial California purees. The values may be expected to vary with varieties and seasons.

Purees prepared at the Citrus Products Station have been evaluated through the medium of milk sherbets. An orange sherbet containing 6 to 7 ounces of sweetened puree per finished gallon was judged superior to any locally available orange sherbets, including that of a nationally advertised brand. It was also judged superior to an experimental orange sherbet containing 48 ounces of freshly extracted juice instead of puree, a product judged superior to any commercial sherbet. It appears that peel oil is a major flavor factor in citrus purees since a small proportion of orange puree of high oil content produced a milk sherbet judged superior to a similar sherbet containing a large proportion of freshly extracted juice of low oil content.

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1 Agricultural Chemical Research Division Contribution No. 252.

2 One of the laboratories of the Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration, U. S. Department of Agriculture.

3 The mention of certain trade products does not imply that they are endorsed by the Department of Agriculture over similar products not mentioned.

It is thought that one of the reasons for the high quality of the products prepared from citrus purees may be the high percentage of oxygenated constituents (2) in the emulsified peel oil it contains. While the oxygenated constituents have not been determined in this product, it is well known that the usual methods of manufacturing peel oil results in a partial loss of them because of their partial solubility in water. These constituents are largely responsible for the characteristic flavors and aromas of citrus peel oils. In the manufacture of puree there is no chance for them to escape.

Sherbert Formula

The sherbet formula used with the orange and other citrus purees was as follows:

Gelatin—0.5 ounces dissolved in 2 ounces boiling water.

Milk (evaporated)—12.5 ounces.

Sucrose—2.0 pounds.

Dextrose—12 ounces.

Orange puree—8.7 ounces.

Citric acid (50% Soln.)—Approx. 1 ounce to give characteristic flavor.

Certified food coloring to give characteristic color.

Water to make one gallon.

The above formula represents about .75 percent butter fat and 1.2 percent serum milk solids. There seems to be quite some variance in the butter fat and serum solids concentration used by commercial sherbet manufacturers but in general the values run in the order of 2.0 to 2.5 percent of each. A supply of a commercial sherbet base containing 2 percent butter fat and 3 percent serum solids was obtained and used in the preparation of sherbets using varying proportions of orange puree. It was found that the higher milk solids base masked the delicate orange flavor. Increased concentration of the puree did not overcome the masking of flavor but only raised the peel oil content of the product to the point that it was quite objectionable.

Tangerine Purees

A tangerine puree was prepared from over-ripe fruits which were obtained after the close of the normal processing season (1949) for this fruit. The sherbet prepared from this puree was judged excellent when fresh, having the flavor of prime quality tangerines, but after a few days the sherbet had developed an off flavor much like that of stale fruit. Later a second portion of the puree was used in preparing an identical sherbet with the same result. Thus it is indicated that the flavor change takes place after preparation of the sherbet and not in the frozen puree. Further work with this fruit is necessarily postponed until next season's crop is available.

Lime Purees

Investigation of lime purees was undertaken in the late spring of 1949, again after the close of the normal season for this fruit. The only variety available was the "Tardia" which, like the tangerine, was overripe; and the fruits, though found to be normally acid, had lost all their characteristic lime odor and flavor. The sherbet prepared from the puree was quite palatable and tart but did not have the characteristic lime flavor. Later, when the first limes of the current season began to move to market, some of the "Persian" variety was proccessed. In the resulting sherbet it was found that a bitter characteristic present in the rind of the fruit had been incorporated in the product making it unpalatable. Sometime later more mature Persian limes were obtained and processed to determine whether the degree of maturity influenced the presence of

(Continued on page 22)

Enough
to go around!
The heavy demand for fertilizers for all crops has dwindled the supply of many fertilizer materials.
With grower cooperation, NACO will do its utmost to meet the needs of its customers with fertilizers adequate — if not completely desirable — until such time that all materials are again in full supply.
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NACO Fertilizer Company
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Reports Of Our Field Men . . .

NORTH CENTRAL FLORIDA
V. E. (Val) Bourland

The pesky little spider has been worse this year than we have ever seen them and some groves have been damaged, but most growers have been very alert to the damage that this insect can do and have sprayed or dusted to bring them under control. Mid-season fruit is rapidly disappearing from the trees with a large percentage of it being moved either to the concentrate or single strength canning plants. With the lack of mid-season fruit there is a great deal of interest being shown in the valencia crop, and very good prices are being offered for this variety. Grapefruit continues in demand and there is a flurry of activity by on-the-tree buyers at this time. Attractive prices are being offered and many growers are selling their fruit. Weather conditions have been such that trees are putting on growth and considerable bloom. Vegetable crops are looking good. It appears that a considerable acreage of watermelons will be planted in this section and these growers would like to se a little rain at this time.

SOUTH POLK, HARDEE AND HIGHLANDS COUNTIES
R. L. (Bob) Padgett

Dry weather is presenting a severe problem in Highlands county even at this early date, and every grower equipped with irrigation is taking full advantage of this, what seems to be necessary, equipment. South Polk and Hardee have not suffered too severely as of this writing. Further, we have had some damage from the strong, cool and continued winds by dehydrating the foliage on the trees. This particular territory has had and we are still having the heaviest infection of red spider and purple mite and six spotted mite that we have had for several years. Most growers are either spraying or dusting to keep these pests under control. There will be a general spray with copper this spring and most growers will come in with an application of topdresser in February. Truck crops are well under way in the Lake Istokpoga section and also in Hardee county. The Lake Istokpoga section produced excellent crops of radishes and onions as a new crop this fall.

HILLSBOROUGH & PINELLAS COUNTIES
C. S. (Charlie) Little

Our number one worry at this time (Jan. 22) is the lack of rain. Growers in Pinellas county have been irrigating for some time and a large number of Hillsborough growers have started their watering plants. Red spider and rust mites have caused much leaf damage, and have been unusually difficult to bring under control. This condition is especially true in groves that have been suffering from the drought. To date fruit returns have been good and it is evident that large tonnages have been moved from this territory. The warm weather that we have been having is causing many trees to start a flush of growth and in many instances we have some bloom. Should we have a good rain now and warm weather continue we could expect a very early normal bloom. We are recommending to most of our growers that they make an application of topdresser in early February and most of them are planning to go forward with this program. Fruit droppage has been heavy in recent weeks due to dry weather and insect damage.

SOUTHWEST FLORIDA
Eaves Allison

We haven't had our most profitable season as far as the vegetable crop is concerned, but netiher have we had the most disastrous. Due to the cold weather during the heart of the season, production was curtailed and maturity of the crop delayed. However at the end of the tomato season prices were better and most growers were able to salvage a great deal that at one time they thought would be a loss. Conditions have been quite favorable this spring and if we can go through the season without a major disaster we should have a profitable spring deal. Gladiolus growers are optimistic. Citrus prices have been so much better this year than in former years that we have not heard a single squak. It appears from here that they will continue good and if so then the growers of Florida can announce this as one of the better marketing seasons. Citrus growers are anxiously planning for a bumper crop of quality fruit for next season and will follow a production program that will insure the very best.

POLK COUNTY
J. M. (Jim) Sample

The operators of concentrate and canning plants are taking the play from the fresh fruit shippers at this time as far as prices being paid for fruit are concerned. We are glad to see the grower get plenty of money, but it seems to us that many people are having to suffer because of the one-sided situation. There is definitely a place for both canned goods and fresh fruit and we are hoping that the market will be stabilized. While the drought is not as severe in this section as in other parts of the state we do have many properties being irrigated and new growth and bloom making an appearance. We have had considerable mite damage and have been busy with the spraying and dusting equipment in an effort to bring these pests under control. Many growers will start their spring application of fertilizer in February, using ampie amounts of secondaries along with their regular mixture. Our growers are planning to follow a well planned course of quality production this year by employing the proper spray, fertilization and cultural program.

NORTH CENTRAL FLORIDA
E. A. (Mac) McCartney

There's no doubt prices paid for citrus fruit having been good so far this season, because most of the early and mid-season varieties have been moved. Had prices not been so good we are sure that so much fruit would not have been moved. There is a great deal of activity now in the valencia crop and a large volume of this variety has been sold. Just how high prices will go no one can tell, but growers now realize that they are making a good profit and are hoping that the people to whom they sell will be as fortunate. Fertilizer is being applied in generous amounts with the hope of setting a very nice crop this spring. A complete spray program is being followed to insure real quality with a prayer in the heart of every grower, and as far as that is concerned, everyone connected with the citrus industry, that prices will be equally as good with the beginning of the movement of the new crop this fall. Vegetable growers are going along about as they did last spring as far as acreage and varieties are concerned. Prospects are bright at this time. The fall deal was not too successful on most crops.

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In progress right now and continuin' for the next two months Florida is goin' to see all kinds of fairs . . . big ones, middle sized ones and little ones . . and everyone of them will do its full part in exploitin' Agriculture and other industries in Peninsular Florida. Hundreds of thousands of out of state folks will see these fairs and learn something about the great citrus industry, about the wonderful vegetable crops grown in Florida and about the ever expandin' cattle industry. These visitors will learn about Florida's marvelous year-'round climate and about all the great possibilities to be found in this state. As a result of this widespread interest among home folks and visitors alike these fairs will grow and grow and grow. Some folks attend just to relax but there'll be a lot of others who will come to invest in Florida—to participate in citrus, vegetable, cattle or some other production in Florida. Florida is growin' every year and they's no limit to its possibilities.

We're enjoyin' one of the most prosperous citrus seasons. There is a lot of reasons for this situation and one of the most important is the way the national consumin' public has taken to our citrus concentrate. IT IS GOOD. We sincerely hope, and we believe that it never suffers a cut in quality for it has been QUALITY that has made it such an outstanding product. The housewife is not hard to please as long as she is gettin' what she wants, but she shore won't tolerate low quality at high prices. Growers of the state are doin' their part, too, for they are consistently doing everything they can to produce only the very finest quality fruit. Further, packin' houses are doin' their best to place on the market fresh fruit of excellent quality. They have improved their methods of handlin' and as a result fresh fruit sellers are experiencing less damge to fruit on its arrival at the market.

While the citrus growers has been havin' a most successful season many of the vegetable growin' sections has been havin' trouble. For example the rich growin' section around Okeechobee and the lower east coast had heavy frost which destroyed their crops. This was one of the earliest frosts on record, and then on Christmas day and right afterwards heavy rains added to the damage. Havin' known these vegetable growers for the past twenty years or more though we know they'll come right back with just a little assistance from Nature and be able to care for the demand of the nation for Florida's fine vegetables.

A lot of new chemical spray materials is appearin' on the market at this time and most of 'em have real value. Some of 'em though are dangerous if proper precautions aren't taken in handlin' them, so it'll pay to consult staff members of the Citrus Experiment Station or company representatives as to how you should use them in the field.

We haven't been able to get any reliable information from California as to just how much cold damage they've had. We talked to a friend of ours out there and all we could get from him was: "I hope it's less than I think it is."

Uncle Bill

OBSERVATIONS ON BORON DEFICIENCY IN CITRUS

(Continued from page 7)

made of the fruit on each of ten sprayed trees and a like number of unsprayed trees on September 23, 1949. The sprayed trees averaged 277 fruits and the unsprayed 214 per tree. This difference of about 30 percent is suggestive that the spray treatment either enhanced the set of fruit or retarded subsequent droppage. Recent work (2) in Washington indicates that the set of pear fruit was increased by application of boron spray during the bloom period.

To summarize, it seems highly probable that boron deficiency occasionally exists in Florida citrus groves. The appearance of all of the listed (table 1) foliage and fruit symptoms in the Washington Navel orange trees on sour orange stock, together with the low boron content of leaves and the response to boron spray applications, leave little doubt of positive identification of boron deficiency in this one grove.

It is felt that a better appreciation of the various foliar symptoms that have not previously been associated with boron deficiency in the field, would be useful to growers in detecting early cases, and these could be quickly remedied by the insertion of boron in one of the dormant or (and) post-bloom spray applications. This is especially useful during periods of prolonged drought or in the absence of irrigation; otherwise soil applications should give a quick response under acid soil conditions. Dependence on fruit symptoms for diagnosis would probably result in a lightened crop, as it would then be too late for corrective measures that would influence the crop already on the trees.

The earliest symptom noted, both in the sand cultures and the field, was the yellowing along the midrib and lateral veins. This symptom developed quickly—in a matter of days—and defoliation of such twigs soon followed. The thickened, buckled type of leaf is slower to develop and of longer persistence on the tree. The enlargement of the veins is also a gradual process. Periods of drought accentuate the expression of boron deficiency symptoms.

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Legends to Figures

Figure 1.—Young (4-month-old) shoots of Valencia orange on Rough lemon stock (1/3 natural size: A, Normal shoot from tree grown in sand culture with complete nutrients added; B-D, shoots from trees grown with boron omitted from the culture solution. An early symptom of deficiency is the yellowing of midrib and lateral veins (b), followed by curling (c), accentuated venial chlorosis, yellowing, and defoliation (d).

Growers Advised To Order Their Fertilizers Early

"Only by ordering fertilizers now for immediate shipment will the grower be assured of having plenty on hand at planting time," say leading fertilizer manufacturers. Growing concern over the slow movement of fertilizers and the potash strike has led some manufacturers to adopt a policy that all orders for future shipment are subject to the goods being available at the time of shipment.

Many growers have shared the opinion that mixed fertilizers would be plentiful during the coming spring season, but authoritative sources point out two important factors which might cause a serious fertilizer situation.

"(1) Lack of interest on the part of growers in taking early delivery of fertilizers. If the anticipated amount of mixed fertilizers is used this spring, it will be next to impossible for the industry to meet these requirements unless deliveries begin immediately. Most fertilizer plants can ship good, well-cured goods now, but these must be moved out to make room for additional materials coming in. If every farmer postpones his order, the delivery season will be shortened, causing factories to become crowded and shipments to be delayed. Shipping orders can be handled promptly at this time; therefore growers are urged to order now so they will have plenty of fertilizer on hand at planting time.

(2) Potash supply. Three of the major potash producers have been idle since November 19, because of a labor strike. No settlement has been reached, although negotiations have been underway for some time. A considerable production of this important plant food has been lost, and each day the strike continues lessens the amount of potash that will be available in time for use this spring. Actually, a serious potash shortage has developed."

The fertilizer representatives stated that they were not alarmists, but that in view of these circumstances, it is of utmost importance that fertilizers be ordered now for immediate shipment.

INSECT CONTROL IMPERATIVE TO FRUIT GROWERS . . .

"The fruit grower must control insect pests or go out of business," the United States Department of Agriculture's fruit insect specialist, Dr. B. A. Porter of the Bureau of Entomology and Plant Quarantine, said in Washington before the Food and Drug Administration Hearings concerning the use of insecticides in the production of fruits and vegetables. These Hearings are currently being held by the Federal Security Agency to determine if chemicals are necessary for growing fresh fruit and fresh vegetable crops.

"Decline of orcharding in certain areas of this country is due in large measure to losses caused by such insects," Dr. Porter said. "This would occur generally and the consumer would be deprived of high-quality fresh fruits which are of tremendous value from a dietary standpoint according to best authorities, if growers do not use insecticides," he pointed out.

"If injury by insects were not prevented, very little undamaged fruit would be available for market. Consumers would receive the insects themselves, or insect remains and insect contamination, along with their fruit. In other words, much of the fruit that would reach the market in the absence of insect control would be unfit for human consumption."

Many measures other than insecticides have been tested for the control of fruit insects since Federal research programs started more than 50 years ago. Parasites, light traps, bait traps, mechanical traps, orchard cultivation practice and use of insect resistant fruit varieties have been explored extensively. None of these alternate methods for fruit insect pest control are satisfactory.

"The fruit grower," Dr. Porter said, "is obliged to place chief dependence for insect control on the use of insect killing chemicals."

Lee County gladiolus growers have been having considerable trouble with Fusarium and bulb rot diseases this season, and most of them are spraying with Dithane regularly in efforts to control these diseases, according to County Agent C. P. Heuck.

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Commercial Handling and Shipping of Fruits and Vegetables

By D. F. Fisher, Principal Horticulturist and Section Chief of Fruit and Vegetable Handling, Transportation and Storage Investigation, Bureau of Plant Industry, U. S. Department of Agriculture, Plant Industry Station, Beltsville, Md.

I have no intention of trying to discuss fruits and vegetables from the standpoint of a nutritionist. That is not my field. But in order to tie in what I have to say with the field of nutrition I think it is proper to state by way of preface that if we can keep fruits and vegetables in the good sound condition and attractive appearance necessary to sell them in the markets, they will maintain their nutritive values very well.

I have been somewhat at a loss to decide how to approach this discussion. We might consider fruits and vegetables as they come fresh from nearby market growers—the ideal kind of produce we all would like to have and so seldom get, unless from our own backyard garden. Or, we can consider the shipped-in produce that comes from growing areas a thousand miles or more away—the kind that you find in the corner grocery store. I think it is this shipped-in produce that will be of most interest not only because it represents the greater part of our supplies but also because it can be, and often is, better than locally grown stuff. This is not because it is inherently any better than local produce but because generally it is produced in a highly specialized area that is particularly adapted to that particular crop. Generally, too, the shipped-in produce is more strictly graded, whereas, all too frequently, the locally grown stuff is not graded at all but is just as it comes from the field. Most important, however, is the fact that the shipped-in produce generally gets prompt and adequate refrigeration which keeps it in good condition from field to market and right on to the corner grocery store, whereas the local produce is seldom refrigerated.

How fresh is this produce? Well, it depends on how long it has been picked or dug—how long since it was harvested—and the temperature to which it has been exposed. Take peas,—for examples—English peas —the ordinary garden type. The thing about peas that we value most is not their starch content that gives them a high caloric value but that sweet garden-fresh flavor that precedes the development of starchiness. Do we stand a better chance of getting what we want in the peas grown nearby and trucked in to the Washington wholesale market—or in those grown in California and shipped 3,000 miles? It is possible of course to have good quality in the local peas if you get them soon enough after they are picked and if they can be kept cold, but I venture to say that you are more apt to find it in the California peas that ordinarily require 10 to 12 days to get to you.

FROZEN PUREES FROM FLORIDA CITRUS FRUITS

(Continued from page 17)

the bitter characteristic. Experiments to date have shown no abatement of this objectionable bitterness as the season progressed.

Since the bitter flavor was obtained with green Persian limes, a puree of ripe Key limes was made to see whether these gave the same result. The sherbet exhibited the same bitter characteristic previously encountered though perhaps to not quite such an extent as that of the Perisan variety.

It is planned that investigations will continue on both these lime varieties and on others as they become available during the coming fruit season. Since lime sherbet is one of the most popular sherbets, it is thought that lime puree would offer an excellent opportunity if the right combination can be found.

Summary

Citrus purees have been prepared from a number of varieties of Florida fruits by the method developed at the Fruit and Vegetable Chemistry Laboratory in Los Angeles, California. The purees were evaluated through the medium of milk sherbets. Florida Valencia orange puree is recommended as an excellent product for use in preparing orange sherbets of superior flavor appeal. It is also suggested that a lower total milk solids sherbet mixture be used than that of present commercial practice in order to obtain the true flavor characteristics of the fruit.

Tangerine and lime purees cannot be recommended at this time. Lemon and other orange varieties will be investigated during the coming season.

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When eggs are plentiful and low enough in price, they can replace part of the meat in the diet.

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Dry weather during the past few weeks has interferred with the planting of 350,000 slash pine seedlings in Alachua County, according to County Agent Loonis Blitch.

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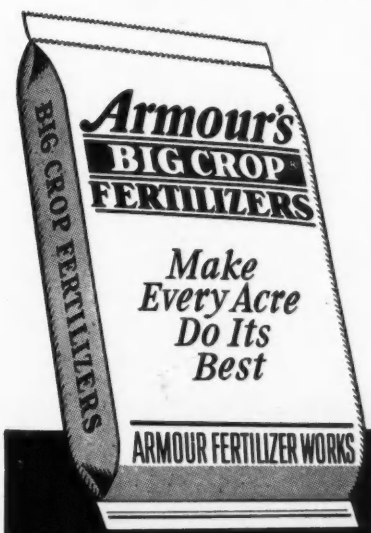

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